A Gradual Transition over Development in Spatial Working Memory

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Early in development there is a transition in spatial working memory. Specifically, Huttenlocher, Newcombe, and Sandberg (1996) found that when remembering a location in a large sandbox, children under the age of 6 were biased toward the center of the sandbox while 9-year-olds were biased away from the center of the sandbox and toward the center of each half. Is this transition a sudden, stage-like change or a more gradual transition?

Schutte and Spencer (2006) tested this using a "spaceship task"—a task in which children had to recall the location of a small, spaceship-shaped target on a table top. They determined that the transition was gradual with the direction of children's memory bias depending on the age of the child and the location of the target. The current study replicates Schutte and Spencer using Huttenlocher and colleagues' sandbox task.

Methods

Participants

Seventeen males and 13 females, 3 to 6 years of age participated in the experiment. They were divided by age into 4 groups [Group 1: mean age = 42.1 mos., range = 38.5 – 45.4 mos. (n=8); Group 2: mean age = 51.8 mos., range = 45.8 – 56.4 mos. (n=7); Group 3: mean age = 63.4 mos., range = 59.9 – 65.4 mos. (n=8); Group 4: mean age = 73.7 mos., range = 65.4 – 79.9 mos. (n=7)].

Procedure

Participants sat on one side of a 60" long x 16" wide x 18" high sandbox with the experimenter directly across from them. The experimenter buried a toy in the sand at one of 8 locations (16", 20", 24", 28", 32", 36", 40", or 44" from the left edge of the sandbox), there was a short delay, and the child was asked to point to the location of the toy.

Results

Responses were collapsed across the midline symmetry axis of the sandbox. Figure 1 shows the mean error to the varying distances from the midline of the sandbox. The responses of the youngest age group (Group 1) were biased toward the midline axis of the sandbox at all locations. In contrast, the responses of Group 2 were only biased toward midline at the location furthest from midline. In contrast, the responses of the other age groups were not significantly biased at any location. Mean error was analyzed in an ANOVA with distance as a within-subjects factor and age group as a between-subjects factor. There was a significant age group by location interaction, $F(9, 78) = 2.56$, $p < .05$, and a significant main effect of age group, $F(3, 26) = 4.84$, $p < .01$. As age increased, overall bias toward midline decreased. There was also a significant main effect of distance from midline, $F(3, 78) = 5.01$, $p < .01$. Responses to the locations furthest from midline were more strongly biased toward midline than the locations closest to midline. This effect was driven mainly by the youngest age group.

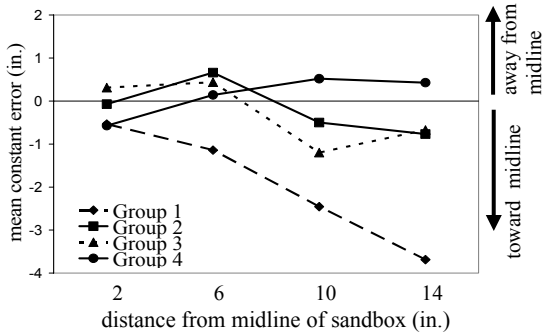

Figure 1: Mean error for each age group.

Discussion

Results supported a gradual transition. The bias toward midline gradually reduced as age increased. This general pattern replicates Schutte & Spencer (2006). The details were not the same as Schutte and Spencer, however. Specifically, the transition began slightly later in development in the sandbox task, and lasted longer. Specifically, no groups were biased away from midline, although the oldest group started to show a hint of a bias away from midline at the targets furthest from midline. This differs from Schutte and Spencer (2006) who found a significant bias away from midline by 4 years of age.

References

Huttenlocher, J., Newcombe, N. & Sandberg, E. H. (1994). The coding of spatial location in young children. *Cognitive Psychology, 27,* 115-147.

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